

## CLAIMS

*Sub AS*

1. An aqueous liquid composition of matter suitable for treating a metal substrate, either directly or after formation of a chemical plating layer or a phosphate conversion coating layer over said metal substrate, to form over the substrate a corrosion protective layer with excellent adhesion to subsequent paint coatings, said aqueous liquid composition comprising water and the following components:

5 (a) from 20 to 70 percent by weight of non-volatile constituents of a component selected from a group consisting of urethane resins, epoxy resins, and acrylic resins;

10 (b) from 10 to 60 percent by weight of non-volatile constituents of a component of silane coupling agent; and

(c) from 10 to 40 percent by weight of a component of dispersed solid non-volatile particles with a mean particle size of 1.0  $\mu\text{m}$  or less,

15 all of the percentage values specified above for components (a), (b), and (c) being percentages of only the non-volatiles content of said aqueous liquid composition.

2. A liquid composition according to claim 1, wherein component (c) is selected from the group consisting of plastic pigments, phosphorus-containing anti-rust pigments, and colloidal-sized silica (including fumed silica), alumina, zirconia, and titania.

3. A liquid composition according to claim 2, in which the pH is in a range from 2 to 20.

4. A liquid composition according to claim 1, in which the pH is in a range from 2 to 10.

5. A process for making a coated metal substrate, said process comprising operations of:

25 (I) forming a layer of a liquid composition according to claim 4 over at least one of a metallic surface of said metal substrate, a surface formed by chemical plating on a metallic surface of said metal substrate, and a phosphate conversion coating formed on a metallic surface of said metal substrate, said layer of said liquid composition having a non-volatiles content that is from 0.05 to 1.0 g/m<sup>2</sup>; and

(II) drying said layer of liquid composition, without removing any of said liquid by any other method than volatilization, to form a dry coating.

30 6. A process for making a coated metal substrate, said process comprising operations of:

(I) forming a layer of a liquid composition according to claim 3 over at least one of a metallic surface of said metal substrate, a surface formed by chemical plating on a metallic surface of said metal substrate, and a phosphate conversion coating formed on a metallic surface of said metal substrate, said layer of said liquid composition having a non-volatiles content that is from 0.05 to 1.0 g/m<sup>2</sup>; and

(II) drying said layer of liquid composition, without removing any of said liquid by any other method than volatilization, to form a dry coating.

7. A process for making a coated metal substrate, said process comprising operations of:

(I) forming a layer of a liquid composition according to claim 2 over at least one of a metallic surface of said metal substrate, a surface formed by chemical plating on a metallic surface of said metal substrate, and a phosphate conversion coating formed on a metallic surface of said metal substrate, said layer of said liquid composition having a non-volatiles content that is from 0.05 to 1.0 g/m<sup>2</sup>; and

(II) drying said layer of liquid composition, without removing any of said liquid by any other method than volatilization, to form a dry coating.

8. A process for making a coated metal substrate, said process comprising operations of:

(I) forming a layer of a liquid composition according to claim 1 over at least one of a metallic surface of said metal substrate, a surface formed by chemical plating on a metallic surface of said metal substrate, and a phosphate conversion coating formed on a metallic surface of said metal substrate, said layer of said liquid composition having a non-volatiles content that is from 0.05 to 1.0 g/m<sup>2</sup>; and

(II) drying said layer of liquid composition, without removing any of said liquid by any other method than volatilization, to form a dry coating.

9. An article of manufacture comprising a coated metal surface formed by a process according to any one of claims 5 through 8.

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